# Master of Technology in Computer Science

**First Semester**

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title</th>
<th>Periods per Week</th>
<th>Max Marks (Theory)</th>
<th>Continual Internal Assessment</th>
<th>Exam Duration Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT-101</td>
<td>Computer Architecture &amp; Parallel Processing</td>
<td>4</td>
<td>75</td>
<td>25</td>
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<tr>
<td>MT-102</td>
<td>Computer Networks</td>
<td>4</td>
<td>75</td>
<td>25</td>
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<tr>
<td>MT-103</td>
<td>Computer Oriented Optimization Method</td>
<td>4</td>
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<tr>
<td>MT-104</td>
<td>Data Structure &amp; Algorithm Analysis in C</td>
<td>4</td>
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<tr>
<td>MT-105</td>
<td>Operating System &amp; Case Studies</td>
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<td>Practical on MT-103</td>
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<tr>
<td>MT-107</td>
<td>Practical on MT-104</td>
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**Second Semester**

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<th>Exam Duration Hours</th>
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<tbody>
<tr>
<td>MT-201</td>
<td>Object Oriented Programming with JAVA</td>
<td>4</td>
<td>75</td>
<td>25</td>
<td>3</td>
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<td>MT-202</td>
<td>Software Engineering</td>
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<td>MT-203</td>
<td>Distributed Data base Management system</td>
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<tr>
<td>MT-204</td>
<td>Artificial Intelligence &amp; Expert System</td>
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**Third Semester**

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<th>Paper No.</th>
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<th>Max Marks (Theory)</th>
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<th>Exam Duration Hours</th>
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<td>MT-301</td>
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<td>Elective</td>
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<tr>
<td>MT-302</td>
<td>Seminar</td>
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<td>MT-303</td>
<td>Minor Project</td>
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</tbody>
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**Fourth Semester**

MT-401    Dissertation

### List of Electives

- MT-E01  Numerical Computing
- MT-E02  Automata Theory and Compiler Design
- MT-E03  Graph Theory
- MT-E04  Cyber Law
- MT-E05  Research Methodology
Computer Architecture & Parallel Processing

PART-A

Parallel Computer Models: The state of computing, Multiprocessors and multicomputers, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks.

Program and Network Properties: Conditions of Parallelism, Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures.

Principles of Scalable Performance: Performance metrics and measures, Parallel processing applications, Speedup Performance laws, scalability analysis and approaches.

Processor and Memory Hierarchy: Advanced processor technology, Superscalar and vector processors, Memory hierarchy technology, Virtual memory technology.

Bus, Cache and Shared Memory: Backplane bus systems, cache memory organizations, Shared memory Organizations, Sequential and weak consistency models.

Pipelining and Superscalar Techniques: Linear pipeline processors, nonlinear pipeline processors, Instruction Pipeline design, Superscalar and superpipeline design.

PART-B

Multiprocessors and Multicomputers: Multiprocessor system interconnects, Cache coherence and synchronization mechanisms, Three generations of multicomputers, Message passing mechanisms.

Multivector and SIMD Computers: Vector processing principles, multivector multiprocessors, compound vector processing, SIMD computer organizations.

Scalable Multithreaded and Dataflow Architectures: Latency hiding techniques, principles of multithreading, Fine grain multicomputers, Scalable and multithreaded architectures, Dataflow and hybrid architectures.

Parallel Models, Languages and Compilers: Parallel programming models, Parallel languages and compilers, Dependence analysis of data arrays, Code optimization and scheduling, Loop parallelization and pipelining.

Parallel Program Development and Environments: Parallel programming environments, synchronization and multiprocessing modes, shared variable program structures, Message passing program development, Mapping programs onto multicomputers.

TEXT:

REFERENCES:

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2. In all 8 questions will be set three from PART -A and four from PART - B of the syllabus. Question no. 8 will be an objective/short answer type question.
3. Examinees will attempt five questions in all. Two each from PART-A and PART-B. Question no. 8 will be compulsory.
PART A


PART-B


TEXT:
1. A.S. Tanenbaum, Computer Networks, PHI.

REFERENCES:
1. Uyless D. Black, Data Communication and Distributed Networks, PH International.
3. James Martin, Computer Networks and Distributed Processing, PHI.

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Introduction to O.R.: Definition, Uses and Limitations of Optimization method.

The Linear Programming Problem: Introduction, Formulation Of LPP, Graphical Solution And Some Exceptional Cases, Canonical And Standard Form Of LPP.

The Simplex Method: Solution of LPP By Simplex Method, Exceptional Cases, Artificial Variable Techniques (Big M), Two Phase Of Simplex Method, Problem of Degeneracy.

The Dual Simplex Method: Dual And Primal Problem, Duality And Simplex Method, Revised Simplex Method, Solution Of LPP Using Revised Simplex Method.

PART-B

The Transportation Problem: Introduction, Basic Feasibility Solution, Standard Transportation Problem, Balanced Transportation Problem, Multicommodity Transportation Problem, Row Minimum, Column Minimum, Matrix Minimum Method, Vogel Approximation Method (VAM), Optimality In Transportation Problem, Degeneracy In Transportation Problem, Assignment And Routing Problem.


Inventory Control: Introduction, Inventory Control, Selective Control Techniques, ABC Analysis Procedure, Economics Lot Size Problems, Problem Of EQQ With shortage, Inventory Control Techniques Uncertain Demand, Stochastic Problems.

TEXT:


REFERENCE:


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Preliminaries: Concept & notation, common operation on data structures, algorithm complexity, time-space trade off between algorithm, physical & logical representation of different data structures.

Arrays: Arrays defined, representing arrays in memory, Various operation (traversal, insertion, deletion), Multidimensional arrays, Sequential allocation, Address calculation, Sparse arrays.

List: Simple Array Implementation Of Lists, Linked Lists, Doubly Linked Lists, Circularly Linked list.


Queue: Queue Model, Array Implementation Of Queues, Applications of Queues.


Hashing: Definition, Hash Function, Separate Chaining, Open Addressing- Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

PART-B


Graphs: Definitions, Representation Of Graphs, Topological Sort, Shortest-Path Algorithms- Unweighted Shortest Paths, DijkstraÂ’s Algorithm, Graph With Negative Edge Costs, Acyclic Graphs, All- Pairs Shortest, Minimal Spanning Tree- PrimÂ’s Algorithm, KruskalÂ’s Algorithm, Application Of Depth-First Search- Undirected Graphs, Biconnectivity, Euler Circuits, Directed Graphs.

TEXT BOOKS:

1. Mullis Cooper: Spirit of C: Jacob Publications
2. Yashwant Kanetkar: Let us C: BPB
5. Robert L. Kruse: Data Structures & Program Design: PHI.

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PART-A


Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions.

Deadlocks: Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock.

Memory Management: Logical & physical address space, Swapping, Continuous Allocation (single partition, multiple partition), internal , external fragmentation, Paging, Segmentation, Segmentation With Paging, Virtual Memory, Demand Paging, Performance Of Demand Paging, Page Replacement, Page Replacement Algorithms - FIFO, optimal, LRU, LRU approximation algorithms, counting algorithms Thrashing, Demand Segmentation.

PART-B


Secondary Storage Structure: Disk Structure, Disk Scheduling, FCFS, SSTF, SCAN, C-SCAN, Look Scheduling, Selection of A Scheduling Algorithm, Disk Management - disk formatting, boot block, bad blocks.


Case Study: UNIX system: Design principles, Programmer interface (File manipulation, Process control, Signals, Process groups, Information Manipulation), Process management (Process control block, CPU scheduling), Memory management (Swapping, Paging), file system (Blocks & fragments, Inodes, Directories), I/O system (Block buffer cache, Raw device interface, C-lists).

Case study: Windows NT: Design principles, System components (H/w abstraction layer, Kernel, Executive), File system (Internal layout, Recovery, Security, Volume management & fault tolerance, Compression), Networking (Protocols, Distributed-processing mechanism, Domains), Programmer interface (Access to kernel objects, Process management, Inter-process communication, Memory management).

Case Study: MS-DOS: User's view of MS-DOS, System's view of MS-DOS, Programmer's view of MS-DOS system calls.

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Object Oriented Programming with JAVA

PART-A
Introduction To Object Oriented Programming: Data Abstraction, Encapsulation, Inheritance (Public, Protected And Private), Polymorphism, Information Hiding.

Java Elements: Data Types, Literal and Variables, Operators- Arithmetic, Bit-wise, Relational, Boolean Logical, Assignment, The ÒOperator, Operator Precedence, Control Statements Selection (if, switch), Iteration Statements (while, do-while, for) Jump Statements (break, continue, return), Arrays (One-dimensional, Multi-Dimensional).

Introducing Classes: Class Fundamentals, Declaring Objects, Methods, Constructors, ÒThis ÒKeyword, Over loading Methods.

Inheritance: Inheritance Basics, Protected Members, Method Overriding, Multiple Inheritance, Template Classes and Functions.

PART-B
Exception Handling: Fundamental, Exception Types, Uncaught Exceptions, Try And Catch, Dealing With Exceptions (try, throw, throws, finally).


Advanced Java Programming: Multithreading ÒJava Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Inter-thread Communication, Multithreading.


TEXT:
1. Patrick Naughten & Herbert Schildt, ÒThe Complete Reference Java , ÒTata McGraw Hill.

REFERENCES:

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PART-A

Function Oriented Design: Design Principles, Module-Level Concepts, Design Notation and Specifications, Structured Design Methodology, Verification, Metrics.

PART-B

TEXT:

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2. In all 8 questions will be set three from PART-A and four from PART-B of the syllabus. Question no. 8 will be compulsory covering the entire syllabus of at least 5 parts.

3. Examinees will attempt five questions in all. Two each from PART-A and PART-B. Question no. 8 will be compulsory.
DISTRIBUTED DATABASE MANAGEMENT SYSTEM

PART-A


Relational Database Management System: Basic Concepts, Data Modeling for a Database, Records and Files, Abstraction and Data Integration, The Three-Level Architecture Proposal for DBMS, Components of a DBMS, Advantages and Disadvantages of a DBMS, Data Models, Data Associations, Data Models Classification, Entity Relationship Model, Relational Data Model, Normalization: Dependency structures, Normal forms.


PART-B

Query Processing: Problem, objectives, Complexity of Relational Algebra operations, Characterization of query processing (Language, Types of Optimization, Optimization timing, Statistics, Decision sites, Exploitation of network topology & Replicated fragments, Use of semijoins), Layers of Query processing (Query decomposition, Data localization, Global & Local query optimizations).

Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanism, Locking based concurrency control algorithm (centralized 2pl, primary copy 2pl, distributed 2pl), Timestamp based concurrency control algorithm (conservative & multiversion TO algorithm), Optimistic concurrency control algorithm, Deadlock management, prevention, avoidance, detection & resolution.

Distributed DBMS Reliability: Reliability concepts & measures (system, state & failures, reliability & availability, mean time between failures/repair), Failures & fault tolerance in distributed system (reason for failures, fault tolerance approaches & techniques), Failures in Distributed DBMS (transaction, system, media & communication failure), Local reliability protocols (architectural considerations, recovery, information execution of LRM commands, checkpointing, handling media failure), Distributed Reliability Protocols (Components, Two-Phase commit protocol, Variation of 2PC).

TEXT:

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PART A
Overview Of A.I.: Definition Of AI, The Importance Of AI, Previous Works In The History Of AI, AI And Related Fields, Problems, Problem Spaces And Search.
Knowledge: General Concepts - Definition And Importance of Knowledge, Knowledge-Based Systems, Representation Of Knowledge, Knowledge Organization, Knowledge Manipulation, Acquisition Of Knowledge.
Formalized Symbolic Logics - Syntax And Semantics For Propositional Logic, Properties Of Wffs , Conversion To Clausal Form, Inference Rules, Resolution.
Structured Knowledge: Graph, Frames and Related Structures- Introduction, Associative Network, Frame Structure, Conceptual Dependencies And Scripts.

PART B
Expert Systems: Definition, Rule Based System Architecture, Non-Production System Architecture, Basic Components of E.S.

TEXT:
1. Dan W. Patterson, "Introduction To Artificial Intelligence And Expert Systems." Prentice-Hall, India.

REFERENCES:

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Introduction: Role of middleware, technologies, dangers of data warehousing, data access to the enterprise, an architectural perspective.

Data warehouse concepts: What is a data warehouse, benefits, need, structure, functions, data mining, operational warehouse.

Types of data warehouse solutions: how to choose a data warehouse, types of data warehouses, host-based data warehouses, host-based single-stage data warehouses, LAN-based workgroup data warehouses, multistage data warehouses, stationary data warehouses, distributed data warehouses, virtual data warehouses.

Data warehouse architecture: Why architecture, architectural components, architectural model, implementation options, decision-support architecture.

Data warehouse technologies: Defining technical architecture, DSS topologies, multidimensional databases, relational OLAP, intranet systems.

Metadata: What is metadata, importance, role, components, repository, model for metadata.

PART-B

Data warehouse modeling: Why data modeling, what is a data model, what is the enterprise data model, data modeling concepts and terms, overall structure and planning process, multidimensional Vs relational model, building a data model, data models for warehouse applications, data model implementation and administration.

OLAP in data warehouse environment: What is OLAP, why OLAP, evolution, concepts, relational OLAP, multidimensional databases, OLAP components, OLAP Vs OLTP, data analysis tools and applications.

Data warehouse tools and products: Corporate data analysis, tools, vendors, products, criteria for selecting systems and database vendors.

Building a practical data warehouse: Prerequisite to success, planning a data warehouse, core components of a data warehouse, enterprise data model, building, using, maintaining a data warehouse, exploiting the data warehouse architecture, creating the data warehouse, implementing the data warehouse, factors for success.

Managing the growing data warehouse: Implementation and maintenance, establishing the right environment, key issues in managing a data warehouse, managing the data warehouse.

TEXT:

REFERENCES:
1. Inmon, W. H. †Building the Data Warehousing†, John Wiley & Sons.
2. Inmon, W. H. †Managing the Data Warehousing†, John Wiley & Sons.
1. Each theory paper shall be of 3 hours duration and shall carry 100 marks (75 marks for written semester examination and 25 for internal assessment).

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PART-B

Two Dimensional Viewing: Window-To-Viewport Coordinate Transformation, Clipping Operations, Point Clipping, Line Clipping, Nicholl-Lee-Nicholl Line Clipping, Polygons Clipping (Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping), Curve Clipping, Text Clipping.

Three Dimensional Concepts: Three Dimensional Display Methods - Parallel Projection, Perspective Projection, Surface Rendering.

Three Dimensional Transformations: Translation, Rotation, Scaling, Reflection, Shear.

Curves and Surfaces: Bezier Curves, B-Spline Curves, Fractal Geometry Methods, Octrees.


Concept of Shading: Modelling Light Intensity, Diffuse And Specular Reflection, Refracted Light, Concept Of Shading Methods.

TEXT:


REFERENCES:


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Inverse Interpolation: Connection between inverse Interpolation and solution of Equation, Roots by inverse Interpolation, Regula Falsi, Newtons method.

PART-B

TEXT AND REFRENCES:

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Finite Automata and Regular Expression: Finite State System, Basic Definition, Deterministic and Non-Deterministic Finite Automata (Only Definition), Finite Automata With Output, Regular Expression.

Turing Machines: Definition Of Various Version Of Touring Machines, Deterministic, Non-Deterministic, Two-Way, Infinite Tape, Multi Tape, Multi Head, Statements Of Their Equivalence (Without Proof), Construction Of Turing Machines (Any Model) For Log N; N!, N^2;


Properties Of Context -Free Languages : The Pumping Leema For CFL's Closure Properties Of CFL'S , Decision Algorithms For CFL'S.

PART-B


Bottom-Up Parsing: Handles, Handle Pruning, Stack Implementation In Shift Reduce Parsing, Conflicts In Shift Reducing Parsing, LR-Parsers, LR Algorithm, LR Grammars, Constructing SLR Parsing Tables, Using Ambiguous Grammars, Error Recovery In LR Parsing.

TEXT :


REFERENCES:


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Introduction
Definition of a graph, application of graphs, finite and infinite graphs, incidence and degree, isolated vertex, pendant graph, null graph.
Path and circuits-Isomorphism, subgraphs, walks, paths, circuits, connected graphs, disconnected graphs and its components, Euler graph, operations on graphs, Hamiltonian paths and circuits, travelling salesman problem.
Trees and fundamental circuits- Trees, properties of the trees, pendant vertices in a tree, distance and centres in a tree, rooted and binary trees, on counting trees, spanning tree, fundamental circuits, finding all spanning trees of a graph, spanning tree in a weighted graph.

PART-B
Planar and Dual graphs- combinatorial Vs. Geometric Graphs, planar graphs, different representations of a planar graph, detection of planarity, Geometric Dual, combinatorial dual, thickness and crossings,
Matrix representation of graphs- Incidence graph, submatrices of A(G), circuit matrix, cut-set matrix, path matrix adjacency matrix.
Directed Graphs- Definition of a directed graph, types of digraphs, digraphs and binary relations, directed path and connectedness, trees with directed edges, fundamental circuits in a digraph, adjacency matrix of a graph, acyclic digraphs and decyclization.
Graph algorithms- algorithm for connectedness, a spanning tree, a set of fundamental circuits, directed circuits, shortest path algorithm, depth search first on a graph, algorithm for planarity testing, algorithm for isomorphism.

TEXT:
1. Narsingh Deo, "Graph Theory", Prentice Hall India.

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Part-A
Liability: Contractual Liability, Strict Liability, Negligence, Criminal.
Miscellaneous (Briefly); Copyright & Patent Protection, Evidence, Protecting Confidential Information.

Part-B
The Information Technology Act, 2000:
Introduction: Definition, A Brief Summary of the Act.
Digital Signature & Electronic Governance (Sections 3 to 10)
Secure Electronic Records & Secure Digital Signatures (Sections 14 to 16).
Regulation of Certifying Authorities (Sections 17 to 34).
Digital Signature Certificates (Sections 35 to 39).
Duties of Subscribers (Sections 40 to 42).
Penalties, Adjudication Offences (Sections 45 to 47 & Sections 65 to 78).
Cyber Regulations Appellate Tribunal (Sections 48 to 64).

Text Books:

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Overview of C: General structure of C Program.

Data types, Operators and expressions: Constants and Variables, Data types, Declaring Variables, Storage Classes, Different types of expressions and their Evaluation, Conditional Expression, Assignment statement, Enumerated data type, Redefining/ Creating data types, Library functions, Type casting.

Input/Output: Unformatted and formatted I/O Functions (Character and strings I/O, \texttt{Scanf} (), \texttt{Printf} ()

Control Statements: Decision making using \texttt{if}, \texttt{if-else}, \texttt{elseif} and \texttt{switch} statements, Looping using \texttt{for}, \texttt{while} and \texttt{do-while} statements, Transferring Program controlling \texttt{break} and \texttt{continue} statements, Programming examples to illustrate the use of these control statements.

Pointers: Definition, Need of pointers, declaring Pointers, Accessing Values via Pointers, Pointer arithmetic, Types of pointers.

Functions: Defining a function, Local variables, \texttt{return} statement, invoking a Function, specifying and passing arguments to a function, Functions returning non Integer, External, static, and register variable, block structure, initialization and recursion.

Structures: Declaring a structure type, Declaring Variables of structure type, Initializing Structures, Accessing Elements of structures, arrays of structures, nested structures, Pointers to structures.

PART-B

Preliminaries: Concept & notation, common operation on data structures, algorithm complexity, time-space trade off between algorithm, physical & logical representation of different data structures.

Arrays: Arrays defined, representing arrays in memory, Various operation (traversal, insertion, deletion), Multidimensional arrays, Sequential allocation, Address calculation, Sparse arrays.

Linked List: Definition, type (linear, circular, doubly linked, inverted), representing linked lists in memory, advantages of using linked list over arrays, various operations on Linked list (traversal, insertion, deletion).

Stacks: Definition & concepts of stack structure, Implementation of stacks, Operation on stacks (push & pop), Application of stacks (converting arithmetic expression from infix notation to polish and their subsequent evaluation), quick sort technique to sort an array, recursion.

Queue: Definition & concept of queues, implementation of queue, operation on queues (insert & delete), Type of queues (circular queue, priority queue).


Graphs: Description of graph structure, Implementing graphs in memory, Graph traversals (Depth First Searching, Breadth First Searching, Shortest Paths Problems).

Sorting & Searching: Selection sort, Bubble sort, Merge sort, Radix sort, Quick sort, Sequential search, Linear search and their complexity.
TEXT BOOKS:

6. Mullis Cooper: Spirit of C: Jacob Publications
7. Yashwant Kanetkar: Let us C: BPB
10. Robert L. Kruse: Data Structures & Program Design: PHI.

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5. In all 8 question will be set three from PART -A and four from PART - B of the syllabus. Question no. 8 will be an objective/short answer type question.
6. Examinees will attempt five questions in all. Two each from PART-A and PART-B. Question no. 8 will be compulsory.
Basic Concepts, Data Modeling for a Database, Records and Files, Abstraction and Data Integration, The Three-Level Architecture Proposal for DBMS, Components of a DBMS, Advantages and Disadvantages of a DBMS.

Data Models, Data Associations, Data Models Classification, Entity Relationship Model, Relational Data Model, Network Data Model, Hierarchical Model.

File Organization, Serial Files, Sequential Files, Index-Sequential Files, Direct File, Secondary Key Retrieval, Indexing Using Tree Structures.

The Relational Model, Relational Database, Relational Algebra, Relational Calculus.

Relational Database Manipulation, SQL, Data Manipulation, Basic Data Retrieval, Condition Specification, Arithmetic and Aggregate Operators, SQL Join: Multiple Tables Queries, Set Manipulation, Categorization, Updates, Views: SQL, QUEL, Data Definition, Data Manipulation; QUEL, Condition Specification, Renaming, Arithmetic Operators, Multiple Variable Queries, Aggregation Operators in QUEL, Retrieve into Temporary Relation, Updates, Views.

PART-B


The Hierarchical Data Model, The tree Concept, Hierarchical Data Model, Data Definition, Data Manipulation, Updates, Implementation of the Hierarchical Database.

Concurrency Management, Serializability, Concurrency Control, Locking Scheme, Timestamp-Based Order, Optimistic Scheduling, Multiversion Techniques, Deadlock and Its Resolution.


TEXT:


REFERENCES:

4. Each theory paper shall be of 3 hours duration and shall carry 100 marks (75 marks for written semester examination and 25 for internal assessment).

5. In all, 8 questions will be set, three from PART-A and four from PART-B of the syllabus. Question no. 8 will be an objective/short answer type question.

6. Examinees will attempt five questions in all. Two each from PART-A and PART-B. Question no. 8 will be compulsory.